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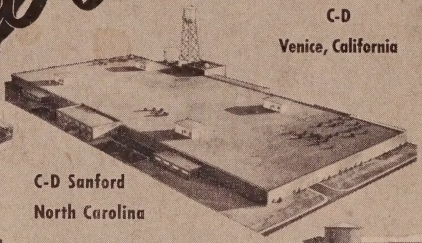

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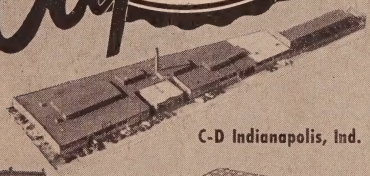

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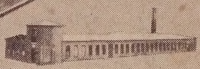

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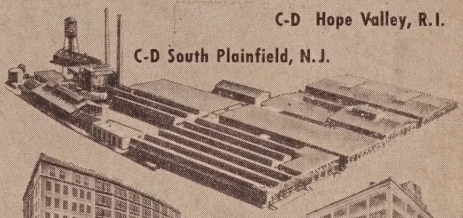

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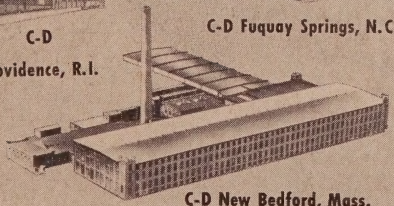

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Vol. 21 DECEMBER, 1956 No. 12

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A TRANSISTORIZED WATTMETER

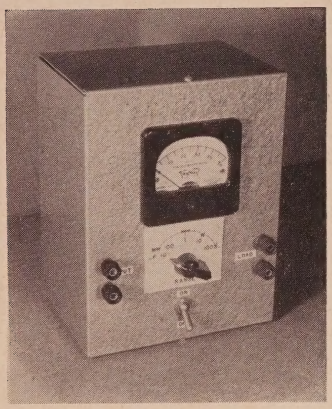

Fig. 1. Over-all view of the completed wattmeter. The instrument is housed in an 8" x 6" x 4½" aluminum chassis box. Refer to Figure 5 for identification of components.

Electronic wattmeters have become popular for the measurement of low and medium power levels, especially in audio practice. Such instruments provide wide range, good frequency response, and versatility. The conventional instrument employs vacuum tubes and must be connected to the power line. There has been some objection to a battery-operated version of the electronic wattmeter because of the initial and replacement expenses of the required A and B batteries.

There are many applications in which battery operation would be desirable, since isolation from the power line permits more flexible operation. Some advantages gained from battery operation are: complete portability, elimination of hum troubles, reduction of interaction, and minimizing of stray coupling. The replacement of tubes with transistors in the wattmeter permits economical battery operation and greatly reduces the weight of the instrument. This article describes a transistorized variation of the familiar electronic wattmeter.

Operating Principle

Figure 2 illustrates the basic operating principle of the electronic wattmeter. Figure 2(A) shows the fundamental situation. Here, R_L is a load resistor connected to the output of a signal source, usually an amplifier, the power output of which is to be measured. The resistance of R_L is chosen equal to the output impedance of the source. The a-c voltmeter indicates the voltage (E) developed across R_L. The power is calculated from the relationship of the voltage and resistance: $P = E^2/R_L$. When E is expressed in volts and R_L in ohms, P is in watts.

In order to obtain a wide measurement range, the meter must indicate millivolts as well as volts. This permits the checking of the milliwatt levels encountered in both experimental and routine audio power measurements and in the checking of power gain.

The meter scale may be made direct reading in watts according to some specified value of R_L. When R_L is changed to some other value, suitable scale correction must be made. If R_L is made 1 ohm, P becomes equal simply to E^2. This value of resistance then may be referred to as the **standard load resistance,** as it is labelled in Figure 2.

Since the standard load resistance will be some value, such as 1 ohm, which is lower than most values required in practice, additional resistance (R_X) must be added externally in series to make up the total required load resistance. When R_L conveniently is 1 ohm, the direct wattage readings

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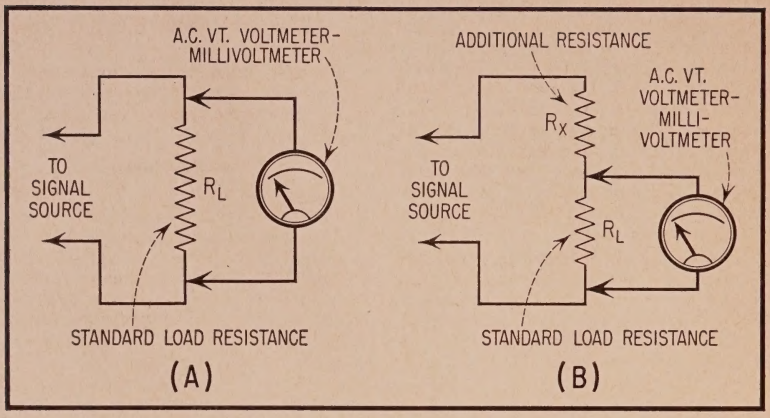


Fig. 2. Principle of Wattmeter.

of the instrument then simply are multiplied by $R_X + R_L$ to obtain the true power value. For example, with a 1-ohm standard resistance a meter deflection of 5 volts indicates 25 watts. If, on the other hand, a 10-ohm load was required and was obtained by adding 9 ohms at R_X (Figure 2-B), the true power would be $25(9+1) = 25(10) = 250$ watts.

A wide-range wattmeter therefore may be obtained by making a wattage calibration of the meter scale on the basis of a 1-ohm load and providing for the connection of external series resistance to make up other desired load values.

Complete Circuit

The principle just described is utilized in the circuit of the transistorized wattmeter. Figure 3 shows the complete schematic.

The input signal (from the power source) is applied to terminals A and B. Additional, external resistance (if the source output impedance is higher than 1 ohm) is connected to terminals C and D, which places this resistance in series with the 1-ohm resistance, R_0. When the desired load resistance is 1 ohm, terminals C and D simply are jumpered together.

The voltage drop across R_0 is applied to the electronic voltmeter-millivoltmeter which consists of a 3-stage, high-gain, transistorized amplifier followed by a bridge rectifier and d-c microammeter. Four voltage ranges are available by adjustment of the RANGE switch, S_1: 0-0.1, 0-0.333, 0-1, 0-3.33, and 0-10 volts rms. These correspond to power ranges of 0-10 and 0-100 milliwatts, 0-1, 0-10, and 0-100 watts, respectively. Applied voltages higher than 10 v are not recommended, since they will exceed the peak inverse voltage rating of the input transistor.

The ranges are governed by the values of the multiplier resistors R_1 to R_7 which form an input potentiometer with resistor R_8 as the fixed leg. The input resistance of the amplifier accordingly varies from 100,000 ohms on the 0.1 v (10 mw) range to 10 megohms on the 100-watt (10 v) range. These high input-resistance values result in practically zero loading of R_0. The amplifier over-all gain is adjustable by means of potentiometer R_9 which thus serves as the CALIBRATION control of the instrument.

The amplifier is RC-coupled. The coupling capacitors (C_1 to C_4) are 20 ufd, 50 v miniature electrolytics (Cornell-Dubilier TAN 63). Degeneration, provided by the unbypassed emitter resistors (R_{14} and R_{15}) provide stability. The first-stage transistor is connected as an emitter-follower for high input impedance (500,000 ohms in the absence of resistor R_8). A low-noise type transistor (CK725) is employed in this stage.

The amplifier output-signal voltage is presented to a bridge rectifier comprised by the four 1N34 germanium diodes (D_1 to D_4). The d-c output of this rectifier circuit is applied to the 0-50 d-c microammeter, M.

The amplifier receives its d-c operating biases from a midget 22½-volt battery, B, with its 6-volt tap supplying the first amplifier stage only. A double-pole switch (S_2-S_3) is required to disconnect both B-minus leads simultaneously.

For best accuracy, the range resistors (R_1 to R_8) must be selected for the exact resistance values specified in Figure 3.

Construction

Figures 1, 4, 5, and 6 show constructional details of the wattmeter.

This instrument is built into an 8" x 6" x 4½" aluminum chassis box (LMB No. 146). Figures 1 and 5 show its external appearance. A somewhat smaller-sized case may be used, if greater compactness is desired.

All of the amplifier and meter-circuit components (with the exception of ON-OFF switch S_2-S_3 and microammeter M) are mounted on a perforated phenolic subpanel (Lafayette MS-305),

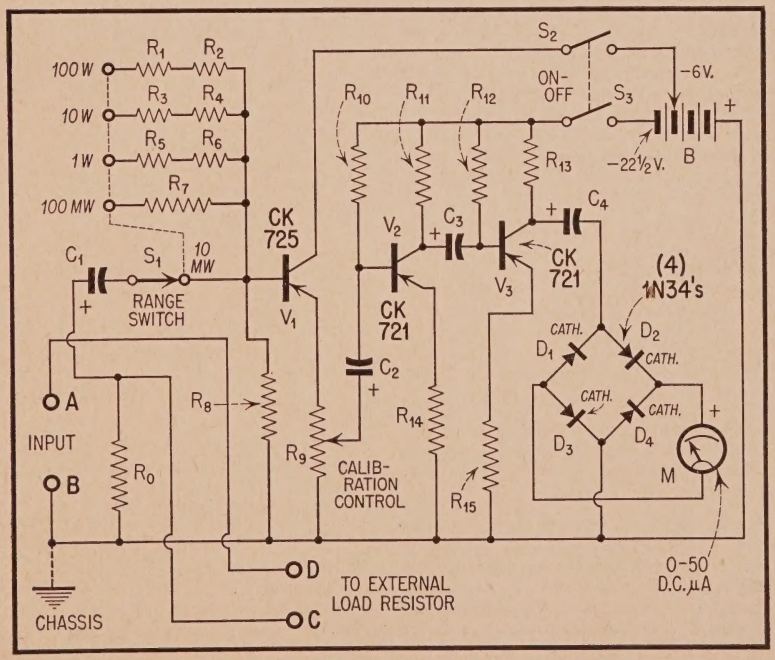


Fig. 3. Complete Circuit of Wattmeter.

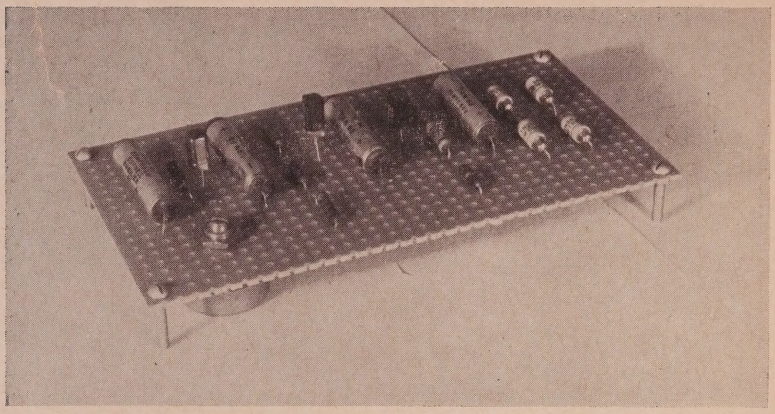


Fig. 4. The Transistorized Amplifier-Voltmeter Subpanel. Refer to Figure 6 for identification of components.

6¾" long and 3¾" wide. Figure 4 shows this completed setup, and Figure 6 identifies its components. The pigtails of all capacitors, resistors, and transistors are passed through the small holes in the panel and are connected underneath to complete the circuit. Potentiometer R_9 is mounted through a ⅜-inch hole drilled near the lower left corner. The panel is held to one inside wall of the instrument case by four ¾"-long 6–32 screws, one mounted in each corner of the panel (See Figure 4).

The shaft of potentiometer R_9 is slotted for screwdriver adjustment, since this unit is set during the calibration of the instrument and does not require frequent readjustment. This potentiometer always should be mounted inside the instrument case to protect its adjustment from accidental disturbance.

The multiplier resistors, R_1 to R_7, are soldered directly to the terminals of the RANGE switch, S_1. Standard load resistor, R_0, is mounted vertically on the inside wall of the case opposite to the one holding the amplifier subpanel, and is connected by means of short direct leads to the input terminals, B and C.

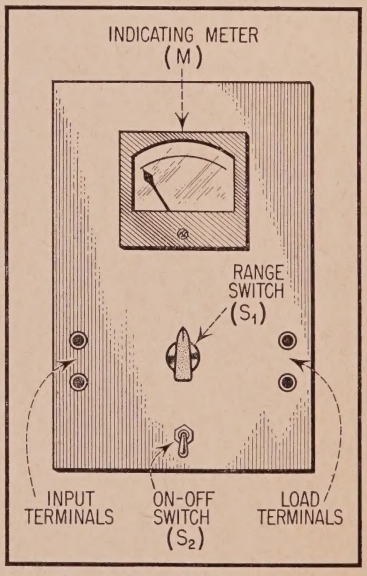


Fig. 5. Front Panel Layout.

Battery B is strapped to the floor of the case, separated as much as possible from resistor R_0.

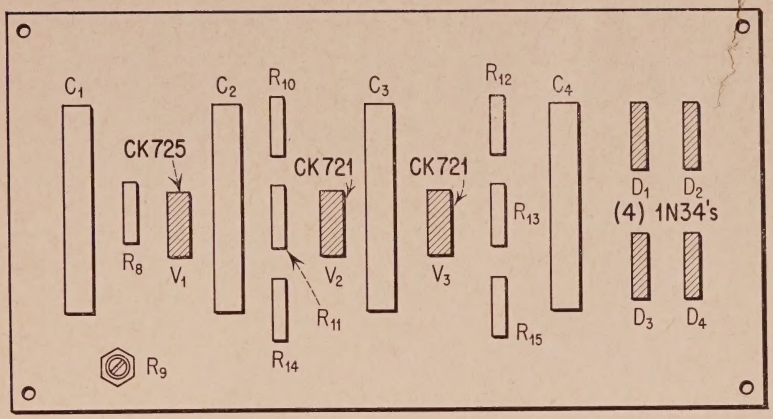


Fig. 6. Amplifier Layout.

Initial Calibration

The instrument is calibrated initially with the aid of a series of accurately-known voltages. Follow this procedure: (1) Set RANGE switch S_1 to its 10 volt (100-watt) position. (2) Connect a variable-output audio signal generator (set to any frequency between 100 and 1000 cycles) to input terminals B and C (B to ground, and C "high"). (3) Temporarily disconnect one terminal of resistor R_O. (4) Connect an accurate a-c vacuum-tube voltmeter to input terminals B and C. (5) Close ON-OFF switch S_2-S_3 and set the generator output exactly to 10 volts rms, as indicated by the vtvm. (6) Set CALIBRATION CONTROL potentiometer R_9 for exact full-scale deflection of microammeter M. **Do not subsequently disturb this setting of R_9.** (7) Set the generator output to 9 volts and record the reading of meter M. Repeat at voltages of 8, 7, 6, 5, 4, 3, 2, and 1 v, and at as many intermediate voltage points as practicable. (8) Using this voltage calibration, refer to the curve in Figure 7 to determine the corresponding watts. (9) From these data, prepare a direct-reading watts card for the microammeter or draw a curve for converting the meter current deflections into watts. (10) Open ON-OFF switch S_2-S_3, disconnect the generator and v-t voltmeter, and reconnect resistor R_O. The calibration now is completed. The accuracy of the instrument on other scales depends upon the quality of the multiplier resistors, R_1 to R_8.

Use of Instrument

Use of the instrument in power measurements is straightforward: (1) Connect the power source (e.g., amplifier or generator) to wattmeter terminals A and B. (2) Connect an external resistance to terminals C and D equal to R_L-1, where R_L is equal to the output impedance of the power source. The power rating of this external resistor must be at least twice the expected power level. (3) Set RANGE switch S_1 to its 100-watt position. (4) Close ON-OFF switch S_2-S_3 and turn-on the power source. (5) Adjust RANGE switch S_1 until the meter deflection is in the upper half of the scale. (6) Read the wattage and multiply this reading by R_L+1.

Example: To check the power output of an amplifier having 16 ohms output impedance. The expected power output is 10 watts.

Connect a 15-ohm, 25-watt resistor to wattmeter terminals C and D. With

R_O of 1 ohm inside the instrument, this makes a total load resistance of 16 ohms. On the 1-watt range, a deflection of ½-watt is obtained. The true power is obtained by multiplying this deflection by 15+1, or 16. Thus: $P = 0.5(16) = 8$ watts.

If the wattmeter normally is to be used for long, continuous periods, adequate ventilation must be provided by means of holes or louvers in the case. When the instrument **always** will be used continuously for long periods, resistor R_O should be mounted outside the case with a protecting cover of perforated metal. This procedure removes the heat from the immediate vicinity of the transistors and diodes.

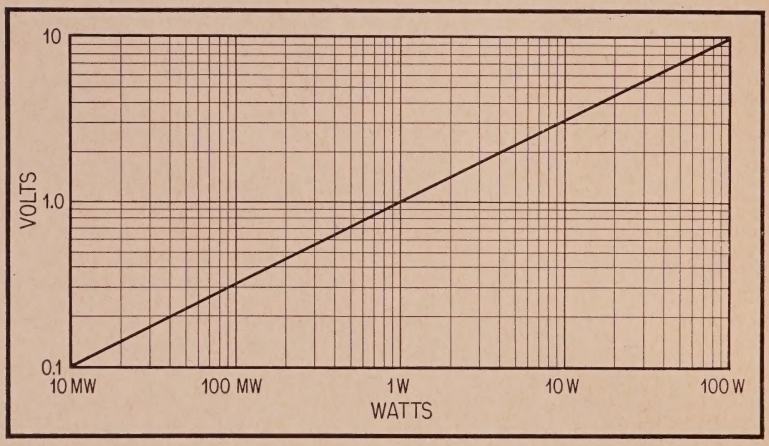


Fig. 7. Calibration Curve.

PARTS LIST FOR FIGURE 3

B—Small 22½-volt tapped battery — Eveready 778

C_1, C_2, C_3, C_4—20 ufd 50 v miniature electrolytic — C-D TAN 63

D_1, D_2, D_3, D_4 — 1N34 germanium diodes

R_O—1 ohm 50 watts — I.R.C. Type 4½E(EP)

R_1—7.5 megohms 1 watt

R_2—2.4 megohms 1 watt

R_3—1.6 megohm 1 watt

R_4—1.3 megohm 1 watt

R_5—750K 1 watt

R_6—150K 1 watt

R_7—200K 1 watt

R_8—100K 1 watt

R_9—20K wirewound potentiometer

R_{10}—1 megohm ½ watt

R_{11}—22K ½ watt

R_{12}—1 megohm ½ watt

R_{13}—22K ½ watt

R_{14}—1K ½ watt

R_{15}—1K ½ watt

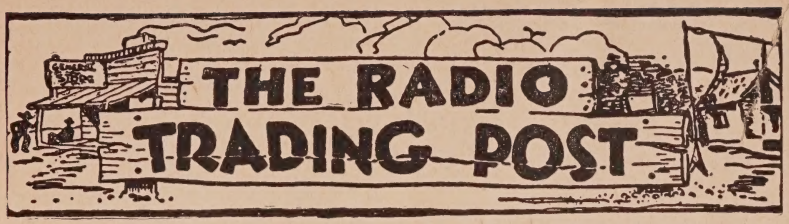
S_1—Single - pole, single - gang, 5 - position, non-shorting rotary selector switch

S_2-S_3—Dpst toggle switch

M—0-50 d-c microammeter

V_1—Raytheon CK725 transistor

V_2, V_3—Raytheon CK721 transistors



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SELL OR TRADE — GE crystal controlled microvolt generator, 100 kc. to 150 mc. on fundamentals; Raytheon 12½ TV in first class working order. Want tape recorder or 35mm camera. Larson's Radio Service, Madison, Minn.

FOR SALE — Rider's manuals: radio, 1, 5, 7-19 inclusive; TV 1-3 inclusive; books. Barbara Tisdale, 70 Knightsbridge Rd., Great Neck, L. I., N. Y.

WANTED — High Voltage condensers, 1000-20,000 v., oil or paper. Wm. Slack, 3716 Belmont Ave., Chicago 18, Ill.

WANTED — Hi-Fi system, Garaud record changer, Columbia 360 record player, recording tape, late radio course. J. T. Wentworth, 106 S. Dearborn St., Mobile, Ala.

SWAP — WE 639 microphone, including 442A jack and 712A adapter, for Altec 670A microphone. Russell Shouse, Jr., 239 S. Hawthorne Rd., Winston-Salem, N. C.

FOR SALE — Emerson 16" TV $15; Simpson cap. bridge, $10; AC meter 2 K O. P. V. in Bakelite case panel undrilled, $5. J. Leach, Box 336, Milton, Del.

WANTED — Modulation xformer for BC-610. State price and cond. J. D. Whitaker, 827 Church St., Marietta, Ga.

FOR SALE — Superior TV-11 professional tube tester, l. n., $30. H. M. Howell, R. 18, Box 17, Indianapolis 24, Ind.

SELL OR TRADE — Precision 920 tube and set tester and E-200 sig. gen., Eico 470 7" scope and 315 delux sig. gen.; McMurdo-Silver 909 sweep gen.; Riders TV manuals, 4, 5, 12, 15 — 18. Control TV, 123 Ave. U, Brooklyn, N. Y.

WANTED — Used test equipment cheap, any condition. Dillon Electric, 65 Washington St., Gloversville, N. Y.

FOR SALE — 40-meter phone xmitter 200 w. input, class B 811 modulator completely TVI'd, 3' delux table rack, $60; 522 rcvr self-contained power supply, 19" panel single dial tuning, $15; Heathkit grid dip meter, $12.50. T. S. Trimmer, R 2, Peekskill, N. Y.

FOR SALE — Complete chassis including dynamic speaker or parts sold separately of Stromberg Carlson 55 (AM) Radio good cond. also Majestic model 72 parts. Robert L. Patterson, 104 Carlton Ave., Brooklyn 1, N. Y.

SELL OR SWAP — Portable tape recorder (Midgetape), with amp, earphone, hand and lapel mikes, carrying case, $125, or trade for radio test equip. R. M. Grant, 2485 Huron St., Baton Rouge, La.

FOR SALE — Hallicrafter S72 3-way portable receiver, good cond. for highest bid or trade. S. Cohen, 1440 Crotona Park E., Bronx 60, N. Y.

SELL OR SWAP — Superior TV-11 tube and cond. checker, used radios and TVs, tubes, coils, hard-to-get items. Want test equip. for TV servicing. R. L. Templeton, 801 No. Pine St., Brady, Tex.

SWAP — Radio-TV parts, etc., for 35 mm. silent films. Vincent J. Malack, 10530 Edbrooke Ave., Chicago 28, Ill.

TRADE — Hi-Fi rig plus cash. Meissner FM-AM M-80 tuner, Bogen PHlo-1 amp. and University 8" Difusicone co-ax, like new, for SX 62A or equivalent, like new. D. Smith, Box 84, Manlius, N. Y.

FOR SALE — Tubes of all types: 14, 15, 19, 31, 33, 34, G53 and G55s; 57s, G2s, G4s, 59-183, WD11, 485, 81, 82, 6E6, 6E7, many others. M. McDevitt, 17 Monument St. Charlestown, Mass.

WANTED — McMurdo-Silver 906 AM-FM sweep gen., working, with instruction book, for cash, or have for sale complete set IRE Proceedings, 1941 to present. A. J. Avis, 12560 Knoll Dr., Los Altos, Calif.

SELL OR SWAP — Bud FCC-90 100 kc. calibrator for best cash offer or audio gear. R. Feigenbaum, 708 West 171st St., New York 32, N. Y.

SELL — National NC-57 receiver, reconditioned, $50; Heathkit FM-2, BR-2, both realigned and tubes checked. Best offer. Richard A. Kirkpatrick, 41 East St., South Hadley, Mass.

WANTED — Good used tape recording equipment by amateur recording club. Give lowest price. California Electronics Guild, 10011 Annetta Ave., South Gate, Calif.

WANT — Auto radio, Ford '49 or '50, in any cond. State price first letter. Local preferred. Edward J. Durkin, 1465 Third Ave., New York 28, N. Y.

TRADE — Eico 7" oscilloscope complete with all probes, like new, for good communication receiver. W. H. Bynum, 1111 Ten Eyck St., Jackson, Mich.

SELL OR TRADE — Riders TV manuals 1-5, $8 each; Precision 912 tube checker, $30; Hickok 305A scope, $30; Weston wattmeter 3kw; 120 folding camera, 4:5 lens. All FOB. Interested in tape recorder. Nick's Radio, 169-10 140 Ave., Jamaica 34, N. Y.

FOR SALE — Truetone table model battery radio, less battery, $4; and Silvertone table model 7056 radio-phono, 78 rpm, $10 plus postage. Need power transformer, type used in D.T.I. home projects. R. M. Massey, 423 Monroe St., Philadelphia 47, Pa.

FOR SALE — Radio and TV service parts, tubes, resistors, condensers. Send for list. Bob's Radio-TV Service, Box 132, Beacon, N. Y.

SELL OR SWAP — 350 radio and TV tubes. Can use good ham gear. George A. Jesse, 930 Second St., Port Edwards, Wis.

WANTED — Teisca miniature crystal mike, model LM5, made in Japan; also complete diagram for #710 Dumont teleset, Canadian rcvr. Edouard Cantin, C. P. 88, Donnacona, Cte Port. Que., Canada.

FOR SALE — Hallicrafters SX-28 with matching spkr., exc. cond. except 10M; 3 Eimac 450TH, guaranteed. Best offer. T. Long, 12043 Claridge Rd., Wheaton, Md.

FOR SALE — Dynamotor, 5.8 in, 600 out at 275 mils., $15; receiver power supply, 6 v. in, 235 v. out, $10. O. Franklyn Griffith, Jr., 613 Brent Street, Winston-Salem, N. C.

WANTED — Pair Walkie-Talkies, Motorola preferred VHF or HF with FM. Have LN Millen grid dipper, many tubes, 4700 VCT HV transformer @ .750A, many LV transformers, and 5 years CQ, QST and others. Make offer. Frank Guetter, Orland Park, Ill.

WANTED — Meissner signal calibrator, model 9-1006; nameplate for BC-683; manual for Weston 665 meter; Mosler 100NE chest. W. E. Schwenzer, 3619 Peach, Erie, Pa.

SELL OR SWAP — Two 12" TV sets, one needs repairs, for meters or what have you? Local preferred. S. J. Lo Nigro, 14 Madeline Ave., Clifton, N. J.

FOR SALE — Heath AR-3 amateur 4-band communications receiver, like new, $25, less cabinet. Earl's Electric, Box 623, Geneseo, Kan.

SELL OR SWAP — Webster model 80 wire recorder; Philco sig. gen., and VTVM. Want communications rcvr, all-band mobile or fixed station xmitter, or tape recorder. John A. Berry, 5802 Master St., Philadelphia 31, Pa.

SWAP — 3-speed Webcor 107-1 changer, like new, for Heath TC-2 or similar tube checker, or ham rcvr AR3 or similar. Good Webcor 210 tape recorder, $60 FOB. Lou Wright, Eagle Grove, Iowa.

FOR SALE — Hardware and Paint Store with radio-TV repair dept. Store 20' x 75', with two 6-room cold water apts., brick building, interior needs repairs, $7,500. George J. Schalk, 2015 E. 38th St., Brooklyn 34, N. Y.

FOR SALE — 10-meter beam in unopened carton, Hy-Lite 3E10PD, like new, $15; 24-hour clock, unused, $10; NC-SW-54, used but good cond., $25. A. Clark, 44 Lewis Lane, Syosset, L. I., N. Y.

TRADE — Omega D-2 enlarger with lenses for HQ 140X receiver or equal; also Kodak Reflex II, for SX-99, NC-98, or equal. Both perfect condition. James MacMurray, 36 Willets Ave., Belmont, N. Y.

WANTED — For Cash, Heathkits W3-M, XO-1, GB-1B, AO-1, QF-1, BE-4. State condition and price. Bruce Sanderson, Box 171, Route 5, Huntsville, Ala.

WANTED — Hickok model 156 traceometer or equivalent. Give full details. A. Campbell, 78 Main St., Dublin, Pa.

SELL OR SWAP — Heath AC-1; Heath ant. impedance meter; Allied's Knight VOM, 1000 ohm per volt; TM's for BC-610E. B. Matthew, 25 Grove Street, Minneapolis 1, Minn.

FOR SALE — Riders Perpetual Trouble-shooters manuals Vols. 3 to 18, 16 manuals in perfect cond., $120; Heathkit TV alignment generator, slightly used, $30. C. H. Cramer, 987 Dayton St., Akron, Ohio.

FOR SALE — Table model radios and tubes; portable 35 mm. silent movie projectors, and 40 reels film. Peter Calderaro, 594 Main, Wakefield, Mass.

FOR SALE — Alexander Hamilton business course, 26 Vols., lessons and study aids; McGraw-Hill Business Library; radio and electrical engineering books; radio and TV parts. Make offer. H. Cobb, Box 123, Azusa, Calif.

FOR SALE — Like new 12 hi-volt molded tubular paper cond., well-known make, .0047 mfd, 5000 v. DC, $1\frac{7}{8}$'' x $\frac{5}{8}$'', $4.50 postpaid. L. Wienreb, 151-09 34th Ave., Flushing 54, N. Y.

FOR SALE OR RENT — Radio and TV courses. Kathryn MacVane, Menlo, Ga.

WANTED — 6198 vidicon type TV camera tube or equal. Pat Blaney, New Straitsville, Ohio.

WANTED — Good used RCA, Crosley, or Westinghouse 10'' to 20'' TV set. State price, details. Robert Carpenter, 201 Holly St., Lenoir, N. C.

SELL OR SWAP — Books on astronomy, etc., for radio gear and equipment. What have you? Send for list. James E. Brugh, 400 Whitney Ave., Pittsburgh 21, Pa.

WANTED — Monitor Crystaliner, complete with all xtals. Prefer model SG-201. A. H. Glines, 46 Winter St., Quincy 69, Mass.

SELL OR TRADE — Picture tube TP-400A, Part #34-2614, for Philco projection, in orig. carton, lists $92. Best offer. K & K Appliance Co., 16950 Lilac, Detroit, Mich.

SWAP — 7 power transformers, hardly used: Polymet TF-754; Merit P-3051; 2 Stancors A-4765's and 2 SP-5015's, and a P-6135. What have you in testing equipment? William Heilbrand, 782 South 19th St., Newark 3, N. J.

SWAP — 8 mm. Kodak movie camera with f1.9 lens, two bulb light bar and screen, for sweep generator. Donald P. Bouchereau, 310 Chetimaches Street, Donaldsonville, La.

WANTED — Monitoradio DR200 FM rcvr, two bands, 30-50 mc and 150-174 mc. Daniel C. Morris, 130 75th St., Brooklyn 9, N. Y.

FOR SALE — Slightly used NC-300 with speaker, $300; S-53A, $65. Both perfect condition. R. J. Swanson, Box 4112, Santa Fe, N. M.

FOR SALE — Supreme 1940 and 1942 radio diagrams, and 1948 FM and TV diagrams, $1.10 each; Kiver's FM and TV Servicing, $1.60; Sams Photofact TV course, $1.60; Electrician's Mate 3rd Naval Training course, 60c. C. Young, 149 Elizabeth St., New York 12, N. Y.

FOR SALE — Miscellaneous Photofacts; 45 w., 3-band CW transmitter kit XTR-1. Morris Radio-TV Service, Shenandoah, Va.

FOR SALE — Heath 0-8 scope, $35; decade resistance DR-1, $15; VTVM V-4A, $12; audio oscillator AO-1, $18; TV align. generator TS-3, $35; tube checker TC-1, $17 FOB, exc. cond., manuals, 15-day money-back guarantee. John Bilane, 109 Normandy Village, Union, N. J.

FOR SALE — RDR 200-400 mcs rcvr; MAW port 100-156 mcs xmtr-rcvr; Weston 695 power meter; Laurence 15 hp. air-cooled, 2-cy. eng. with 5 kw gen. Albert Edwards, 128A Waipao Pl., Aiea, Hawaii.

TRADE — Picture tubes, ARC/5 xmitter, tube testers, VOM meter, RCA Radiola 17, record changer, speakers, power supply, light meter, TV tuner, yokes. Karl G. Muck, R. 2, Warsaw, N. Y.

SELL OR TRADE — 500 radio and TV tubes; American Beauty soldering iron, 200 v., 130 w., $3.50; Anchor booster, $10; volume controls with switch ½ meg. tapped at .25 meg., 60c. John Andrew, 740 Maple St., Bethlehem, Pa.

FOR SALE — Hallicrafters SM-40 S-meter, fits S-40 or 20-R, $5; Heathkit GD-1B grid dipper, $13.50; Heathkit T-3 signal tracer, $15. Postage extra. Glenn Godwin, 19 Grand Boulevard, Apt. 4, Binghamton, N. Y.

WANTED — Instruction manuals for Vomax 900, model 904 cap./res. bridge, Sparks sig. tracer (all mfdg. by McMurdo-Silver), also manual for Hickok RFO-1 3'' oscilloscope. Will buy or rent. Fred Dillion, 1200 No. Olive Dr., Los Angeles 46, Calif.

FOR SALE — Complete 150 w. rig. HQ-129-X, Globe Champ. and VFO, ants., coils, and other equip. Ralph Sherberg, Soo Hotel, Thorp, Wis.

FOR SALE — 35 mm. sound movie system: 2 proj., amp., screen, rewind, film cans, film, cheap; also 40-50 mc FM tuner, E. H. Scott. D. Blanton, 409 So. Broadway, Poplar Bluff, Mo.

FOR SALE — Like new Potter-Brumfield 110 v. AC 4-pole DT relays, $2 each; Allied-Control 110 v. AC DPDT relays, $2 each; 8 mc. crystals for 144-148 mc. band in FT-243 holders, 40c each. G. W. Carter, 8015 Loyola Blvd., Los Angeles 45, Calif.

FOR SALE — 600 v. mica xmitting condensers, various sizes, 25c each; 1000 unused 1 and ½ watt resistors, $10; 100 potentiometers, asstd., $10. M. Levine, 2244 E. 27th St., Brooklyn 29, N. Y.

SELL OR SWAP — Communication and surplus receivers, need repairs. Want VFO and Vibroplex key. Frank Ryder, 259 North Main St., Sayville, N. Y.

FOR SALE — Simpson 480 genescope, factory recalibrated and converted for color TV, $275; Simpson Crosshatch gen., $50. George E. Mraz, 5101 Thomas St., Maple Heights, Ohio.

SELL OR SWAP — Gardener code machine with 12 rolls tape, 110 v. AC motor type, $18, or will swap for VTVM with zero center for FM alignment. George E. Daubert, Apt. A, 111 White Horse Pike, Audubon 6, N. J.

FOR SALE — Misc. xmtr. parts including power supply, 300 ma, 750-1000-1250 v.; 500 w. P.P. triode amps., Hammarlund and National, standard rack mounting, $200. E. Borowski, 289 Pine St., Lyndhurst, N. J.

FOR SALE — $338 value $100: Riders 1-5 abridged, 6-14 inc., Sams 1-50 and 167-196 inc., all like new., 7 other misc. folders included, plus postage. M. L. Kirkpatrick, Muncie Airport, Muncie, Ind.

FOR SALE — Heath 0-6 scope, $22; Eico 950 RC checker, $15, and 221 VTVM with HV probe, $20; 75 w. CW xmtr with power supply, has 5763 and 6146 and Triplett meter. Chas. Moore, 28 Orville St., Glens Falls, N. Y.

WANTED — Highest cash price paid for unaltered BC-221's with modulation and orig. calibration books. Those without modulation accepted. Bolton Laboratories, Inc., Bolton, Mass.

FOR SALE — All components for 950 v. 350 mill output power supply, less rectifiers and chassis, $16 plus postage. Prefer Ft. Worth - Dallas area. Jimmy Pyeatt, 500 E. Ellen Ave., Hurst, Tex.

WANTED — Comm. receiver, prefer Hallicrafter. State model and price. Have 20 w. Olsen Hi-Fi amplifier, $25. Paul Reuter, R. 2, Robinson, Ill.

SELL OR TRADE — S40A Hallicrafter broadcast to 40 mc., integral speaker; 2 volt-ohmeters. My set plus cash for a Hammarlund HQ or SP 600 Jx. Charles Wendell, 63 Forest Hill Pkwy, Newark 4, N. J.

FOR SALE — Heath SG-8 sig. gen., used once, with manual, $18. Kenneth Loveland, 11212 Blossom Blvd., Cleveland 30, Ohio.

WANTED — Single or dual tape recorder, must be a bargain, also Hickok 209A VTVM. H. Howski, 5251 Warwick St., Chicago 41, Ill.

WANTED — GE 19C105 TV chassis less picture tube, working or not; cheap. Have for sale "Communication Engineering," Everitt, $4, like new. O. Kolen, 3A, 102 Roney Lane, Syracuse 5, N. Y.

WANTED — Hi-Fi FM tuner; RCA record player; Hi-Fi components. John J. Conroy, 2523 W. Willard St., Philadelphia 29, Pa.

FOR SALE — Thordarson 60 w. audio transformer 3300 CT to 4-8-16-500 ohms. $4 plus postage. R. C. Evans, 17207 Snowden, Detroit 35, Mich.

FOR SALE — ATR model RSB inverter, 110 DC to 110 AC, 150 continuous wattage, perf. shape, $6.50. John P. McCullen, 3050 Bainbridge Ave., Bronx 67, N. Y.

SELL OR SWAP — Scintillator crystal sodium iodide thallium activated and RCA 5819 photomultiplier for use with counter crystal. Want DX 35 or make offer. M. Goodman, 2621 Burns Pl., Union, N. J.

WANTED — RCA speaker 15" Duo-Cone 515SI, any cond., if repairable; Stancor A8072 trans. Theodore Nadeje, 5101-AA 39th Ave., Sunnyside 4, N. Y.

SELL OR TRADE — Setchell Carlson 15 w. amplifier; VP-554H Mallory vibrapack; 40 w. modulator; 750 v. 250 ma. supply; 45 rpm changer mechanism. Need S-38; grid dipper; AT-1 xmitter; VOM. Stan Zuchora, 2748 Meade St., Detroit 12, Mich.

FOR SALE — RCA 621TS TV, good cond., and GE self-charge portable No. 250, in working cond. Both $50. Manuel Perez, 119-9th Ave., New York 11, N. Y.

FOR SALE — 10" table TV, $10, needs minor service; Meissner FM converter, $10. Want assorted Sams folders, TV only, from #200 to 300. Jack Moser R-1, Lewisburg, Pa.

WANTED — Used TV Booster, need not be working. Have books, mags, short wave adapters, meters, typewriter. Anglado, 719 Doris, Biloxi, Miss.

FOR SALE — Brown 115660-X19 potentiometer for parts only, $50; 30 WE 4 digits register, 1000 ohms .028 am to operate, $3 each. Both FOB. Emil Backstrom, Jr., 6 Pel Pl., Pelham, N. Y.

WANTED — Viking Ranger, factory wired. State cond. and price. W. A. Gillette, 39-39 223 St., Bayside, N. Y.

WANTED — Hickok test equipment. State price and cond., Wayne Sherwin, 1740 North Capital St., NW., Washington, D. C.

WANTED — "Radio Handbook," by Editors and Engineers, Ltd., 14th Edition. Will swap radio mags or ham items. Herbert Greenberg, 821 Rutgers Rd, Franklin Square, N. Y.

FOR SALE — Precise 7½ VTVM, like new, $30 with HV probe; Health TS 1 sweep gen., $22.50; Eico cap and res Bridge, $20; Eico 315 sig gen, $35. P. Ferrina, 4309 Kansas Ave., NW Washington 11, D. C.

WANTED — Good 7180 xtal and mobile antenna coils. Will swap other xtals, right angle attachments for electric drill or what do you need? S. Weiner 20-27 Seagirt Ave., Far Rockaway, N. Y.

FOR SALE — Sweep Generator RCA type WR 59A, excellent cond., recently aligned, with manual, $80; Carter 6 v. dynamotor, never used, 420 VDC at 280 MA., $35. H. Kundrat, Jr., 57 Elizabeth Ave., Cranford, N. J.

WANTED — P-69-17-A Motorola rcvr and T-69-20-A xmitter. State price and cond. Maurice F. Randall, Radio and TV, Warner, N. H.

WANTED — Rcvr, National 81, need not be operating but mechanically OK. Wm. Alexander, R. 1, Newtown, Pa.

WANTED — Recent appliance repair course. State price and cond. John Laflie, 6146 S. Kenneth Ave, Chicago 29, Ill.

FOR SALE — Eico 315 sig. gen., perfect cond. and alignment, will deliver locally. $12.50, or 16 gauge shotgun. Howard Radio, 727 E. 10 St., Brooklyn 30, N. Y.

WANTED — Bird 611 wattmeter, freq. monitors, Lampkin meters, FM two-way equip. R. Phillips, 1312 McGee, Kansas City, Mo.

FOR SALE — Eico 315 deluxe sig. gen., never used, needs alignment. $10. Harry Hoffman, 1704 Ralph Ave., Brooklyn 36, N. Y.

SELL OR SWAP — Approx. 100 copies IRE Proceedings 1949-1956 for cash or audio equipment. H. Roshkind, P. O. Box 747, Westport, Conn.

SELL OR TRADE — Newark RF-AF sig. gen., l. n., range 150 Kcs to 34 Mcs on fundamentals, 68 Mcs on harmonics. What have you? Luke Strader, 1217 Myrtle Ave., Danville, Va.

FOR SALE — Good assortment of back issues Radio and Mechanics magazines 12 for $1.00. Walt Bartell, 5536 Wilson Ave., Chicago 30, Ill.

WANTED — TV service man's tube caddy and tool chest combination. Isidore Olesh, 845 Schenck Ave., Brooklyn 7, N. Y.

FOR SALE — RCA TS 630 TV, complete, $15; Mallory 88 UHF converter, $15; battery charger, 6 v. 10 amps, Sears make, like new, $10. COD. V. Kozma, 12450 NW 5th Ave., Miami 50, Fla.

FOR SALE — Emerson 12½" table TV, 23 tubes, $14.95; 16" Philco console TV, 22 tubes, $19.95. Will ship anywhere. Jones TV, 1115 Rambler Ave., Pottstown, Pa.

FOR SALE — Used books on electronic engineering for college degree at one-half original cost. Write for list. Ed Alpert, 18 Frances St., Needham 92, Mass.

FOR SALE — Heath T-3 signal tracer, $17.50; Heath V-6 VTVM, $15. W. Wright, 123 Putnam Ave., Freeport, N. Y.

SELL OR SWAP — Flyback xformer for Zenith 21K20 TV, A-1 cond., $2 or exchange for pair of 815 tubes. Frank Bou, 47 Oswego Ave., Audubon 6, N. J.

FOR SALE — L N Granco UHF converter model LCU. No reasonable offer refused. D. B. Fritz, 1223 Pike St., Reading, Pa.

FOR SALE — Motorola Airboy 200-400 kc rcvr, no battery, $12.50; Morrow 5BR all-band converter with noise-limiter and manual, $40; homemade 80-40M xtal converter with xtal, $6; 6 v. dynamotor on base, 425 v. 375 ma., $12.50. Phil Hurst, Lamar, Mo.

TRADE — B eliminator and dictaphone with cylinder discs for voltohmeter, and used tube tester. Irving Leibovitz, 3-15 Berdan Ave., Fairlawn, N. J.

SELL OR SWAP — Complete 10 meter mobile; link xmitter; Gonset Super Six-TNS ant. control box, mike and cables. Want Hi-Fi equip. M. Javerbaum, 11 Hobson St., Newark 12, N. J.

FOR SALE — Motorola FMT 50D, or FMTU 30D complete except crystals, $25 each. Frank L. Hicks, 2781 Bankhead Hwy N. W., Atlanta 18, Ga.

FOR SALE — Eico flyback tester, $24; Eico pix tube tester $18; Heath SG-7 sig. gen., $19.50; EMC model 104 VOM, $22; Capehart TV table model 12", needs pix tube, $15, or trade for photoghaphic equip. E. Hudson, R. 2, Beaver Falls, Pa.

SELL OR TRADE — Spraque Tel-Ohmike TO-4 l. n., $50 or what have you in home repair tools? J. Mariani, 549 W. 113 St., New York 25, N. Y.

SWAP — Powercon No. 110 RT 25 for an Eico tube checker No. 625K, (or equivalent) and sig. gen. I. W. Hoffenberg, 259 E. 92 St., Brooklyn 2, N. Y.

WANTED — Mobile equip., especially xmitter, for cash or trade novice HT 17 Hallicrafters CW xmitter complete, multimeters, power xformers, etc. Martin Schiff, 12 Burbank St., Yonkers, N. Y.

FOR SALE — Instructograph with 10 tapes for learning Continental code, l. n., $20 FOB. Ben Murray, 839 E. Grand Ave., Tower City Pa.

WANTED — Overhead cutting lathe and cutting turntable and its playback arm. State cond., specifications, and lowest price. Have for sale Revere T-100 tape recorder good cond. Yale Phonograph Co., 402 Grand Central Ave., Tampa, Fla.

WANTED — Outside motor for Alliance Rotor H1R-2, and complete xformer for TV Booster 3010 Electro Voice. Glen Johnson, R. 3, Seymour, Tenn.

FOR SALE — Portable Heathkit tube tester and batt. eliminators, $15 each. Will ship COD. Roland Staples, Main St., Eliot, Maine.

FOR SALE — SW. 54 National-comm. rcvr; Triplett tube tester, model 3413; GE self-charging portable. C. Horn, 325 E. 163 St., New York 51, N. Y.

FOR SALE — Excellent Babcock MT-5A multiband mobile xmitter. with tubes and LS-1 antenna tuner, $60 postpaid. Steve Schwarz, 1233 W. Birch, Oxnard, Calif.

SELL OR TRADE — 1952 DeForest Radio-TV course, with all equipment,$100; 1. n. 7½ hp. Elgin outboard motor, motor stand, 5 and 3 gal. cans, $100, both for $175. Want test equipment or Sams or Riders manuals. F. K. Meier, 91 Prospect St., Paterson 1, N. J.

SWAP — Hallicrafters SX43 with R44 speaker for good Hi-Fi amplifier with speakers; or Hallicrafters and Admiral 5Y22N Radio-Phono (3 speed) for Hi-Fi complete system housed in cabinet. R. D. Vosbury, 38 Andrews Ave., Binghamton, N. Y.

WANTED — Used Motorola Airboy Sr. transceiver, Learavian portable, Maguire and Air-boy receivers, RCA 109 portable, all for Aircraft Radio Range. State lowest price. James M. Cox, Kirksville, Ky.

FOR SALE — Hickok 505 scope, good cond., $85. Herman D. Wieck, 205 Idlewylde Dr., Louisville 6, Ky.

SELL OR TRADE — Radio correspondence course with kits; 10" RCA TV CR tube; 7" junk TV; GE 45 record player with records. Want battery eliminator, vibrator tester, etc. W. Lamon, 2101 Adriatic, Longbeach 10, Calif.

WANTED — Hickok 650C white dot gen.; early vintage RCA color TV set. Prefer Rockford or Chicago area. Tanrath Radio and TV Service, 2110 Broadway, Rockford, Ill.

FOR SALE — Hallicrafters SX-25 high-freq. communications rcvr, $75 plus postage. Fred Kremkau, 609 Third St., New Cumberland, Pa.

WANTED — Gonset or other commercial-built converter good for 15 meters. State cond. and rockbottom price. Paul Dumais, 36 Parker St. Newton 59, Mass.

SWAP — Unused Mallory Silvertone TV-101 UHF converter with 6AF4 and 6CB6 tubes. Want small phone-CW xmitter for even swap. Ken Johnson, 380½ W. Algoma St. Oshkosh, Wis.

FOR SALE — Regency RT 700-21 TV remote control, $30; Hickok 550X tube tester, $40; 813 final amp. FOB R. H. Hall, 604 Tarento Dr., San Diego 6, Calif.

SELL OR TRADE — Double "00" scale model railroad equip. and accessories; GE motor generator 110 AC-110 DC, .03 kw. Fordom Presto flexible shaft with motor and accessories. Need TV test equip. W. P. Bechtold, 84 Lefferts Rd., Garden City, N. Y.

FOR SALE — SG-6 sig. gen.; T-2 sig. tracer; 3" port. lab. scope; lab. power supply; "Handee" power tool and acess. with case; "Radio and TV Math." Stanley Bombka, 8107 N. Odell Ave., Niles, Ill.

FOR SALE — Instructograph, spring drive with 10 tapes and audio oscillator. Best offer. Leo Perlmutter, 1 Fisher Dr., Mt. Vernon, N. Y.

FOR SALE — Hallicrafter 55W portable radio, $16; Bradshaw resistance capacity, ohmeter, $18; Superior model 70 utility tester, $15. Chas. Wendell, 63 Forest Hill Pkwy., Newark 4, N. J.

WANTED — Unusual or little known cameras for collection, need not be in working order but must be complete. German cameras, 30 years old or less prefered. Exchange for new tubes, parts, and 7" and 14" CRT's. W. Baer, 741 State, Lancaster, Pa.

SELL OR TRADE — Norelco PT. 200A projection set good cond. also electronic converter, input 6 v. DC, output 115 AC, wattage 100. Walter Jones, 57 Swan Lane, Levittown, L. I., N. Y.

FOR SALE — Heath TS4 TV alignment generator, expertly wired. Local only, $35. K. C. Moss, Milbrook, Ave., Dover, N. J.

SELL OR SWAP — Dual speed, dual track Masco 52 tape recorder, good cond., $45 or 8mm turret camera in good cond. Bill Clem, 26 Van Meter Dr., Schenectady 6, N. Y.

FOR SALE — Sylvania 139 tube tester; Hickok 203 electronic multimeter; Precision E-200C sig. gen.; Turner table mike, all 1. n. Joseph Cillo, 46 Saint Edwards St., Brooklyn 5, N. Y.

WANTED — Heath grid dip meter; 304 TL tubes; BC-1306 rcvr. Will sell BC-625 xmitters; BC-683-B rcvr; TU-70 tuning unit. E. L. Felder, Tylertown, Miss.

FOR SALE — Signal Corps U.S. Army test unit 1-236 send $6 money order, Louis Giroux, 735 Park Ave., Hoboken, N. J.

SELL OR SWAP — BC 348, TA-12D xmitter, BC 639 with power supply and ARB rcvr with operator control box. For portable typewriter, 35mm photo equip., or cash. Robert R. Jessup, 109 W. Main, Mascoutah, Ill.

WANTED — Radio for 1956 Chev., part. or all cash. Have 1947 Olds radio, excellent cond. Also need camera, sig. gen. Alfred Kenna, 2200 Hamilton Ave., No. Merrick, L. I., N. Y.

WANTED — Zenith transoceanic portable; good set of batteries 7 band broadcast to 31 MC. Sam Lipson, 1 Kensington Hts., Worcester 2, Mass.

FOR SALE — Riders 1 to 20 and 22; TV manuals 1 to 9 and 40; other radio-TV manuals, to be sold in one lot. E. K. Chenoweth, 845 Union St., Warren, Ohio.

FOR SALE — Heathkit DX-35 xmitter, excellent cond., $50. R. A. Champi, 6W. Washington Ave., Atlantic Highlands, N. J.

FOR SALE — SX 28A; Sonar MR3-522; VX101 35 w. VFO; 100 w. modulator, 150 w. final amp.; Dumont 3" scope; 4 tube 2 meter conv,; TR4 rotator. Make offer. W. M. McDonald, St. Georges School, Newport, R. I.

FOR SALE — Precision 10-54 P tube and set tester, $75; Heathkit TC2 tube tester, $29.95. Both like new. FOB. Frank Wayne, 1012 Bill Rd., Schenectady, N. Y.

FOR SALE — TV and Radio Service shop, busy service section near bus stops, small apartment, yard. Make offer. Paragon TV and Radio Service, 170-26 Jamaica Ave., Jamaica 32, L. I., N. Y.

SELL OR SWAP — Hallicrafter S20R rcvr; xmitting and receiving tubes. Interested in ham or mobile equip. Selwyn Wynstock, 2257 10th St., Douglas, Ariz.

SELL OR SWAP — L. N. Gonset super-six converter; Johnson whip load six loading coil; Mallory Vibrapack, 6 v. input, 300 v. output. Need rcvr S40B. J. A. Scharfe, Manor House, R. 1, Hellam, Pa.

FOR SALE — Rider 1 to 5 abrdg; 6-10, and 12 and 14, $5 each; 17 through 22, $7.50 each. Sams 206 and 212, $1.25 each. Alliance Rotor Model ATR $16. All FOB. Ben I. Guise, 2503 61st St., Des Moines, Iowa.

WANT — Hickok 533A or AP tube tester, like new cond. Paul Capito, 637 W. 21st St., Erie, Pa.

FOR SALE — V-7 VTVM, l. n. includes test leads and instructions, $20 COD. Allan A. Dreier, 1522 N. Clark St., Appleton, Wis.

FOR SALE — Used Zenith table model H72521 super-symphony AM-FM radio rcvr in excellent working cond. Best cash offer. D. Landesberg, 179 Marcy Ave., Brooklyn 11, N. Y.

TRADE — Gonset Tri-Band converter 75, 20, 11, 10 meters, for low power xmitter 40 or 75 meter novice bands. Laurie Sansbury, 213 W. Elm St., Florence, S. C.

FOR SALE — Sprague Kwick-Test Capacitor checker KT-1, $20. Joseph W. Schwarz, 649 Arnow Ave., Bronx 67, N. Y.

BUY OR TRADE — Gov't tech. manuals on electronics state items you have and price. Have surplus radio gear to swap. John Meshna, 580 Lynn St., Malden 48, Mass.

WANTED — S meter 0-1 MA for S-40A Hallicrafter rcvr. Will trade postage stamps of the world, or pay cash. William Wozniak, 5327 Deley Pl., Gary 5, Ind.

WANTED — Two 2-meter portable rigs. Prefer transceiver, battery operated. Give details and price. K. K. Miller, Box 65, Groton, Conn.

WANT — Tank condenser, KW size 3,000 v. or higher spacing, desk-side cabinet. Harold MacDonald, Box 593, Kodiak, Alaska.

WANTED — Superior powerstats, type 10, 1.25A for cash or trade. R. H. Rogers, 28 Bellamy St., Boston 35, Mass.

FOR SALE — Riders manuals vols. 9 through 17, $65 or best offer. Philip Meyer, Pompton Lakes, N. J.

WANTED — National SW-3 coils or coil forms for cash or trade. Joseph D. Griggas, 258 Coe Rd., Clarendon Hills, Ill.

FOR SALE — Presto model K portable sound recorder, good cond. Best offer. Carl A. Hayden, 987 Lafayette Ave., Brooklyn 21, N. Y.

FOR SALE — Recording-playback 16" turntable with arms, equalizer, gross blank discs; 1-10A rcvr; 2350V xformer and choke, l. n. Best offer. Townsley, 5919 Almaden, Oakland 11, Calif.

WANTED — 1920-22 Radio call books, Hallicrafters S-20-R, S-85, SX-96. State condition and price. C. Wegrzynowski, 51 North Central St., Buffalo 12, N. Y.

SELL OR TRADE — GE 12" TV, 20-tube table model, wood cabinet, excellent working cond., $24.95. Campbell's TV, Box 183, Dublin, Pa.

CASH — For used NRI Service-Communications course, in good cond., including kits. C. de Grijze, 25 Bogart St., Brooklyn 6, N. Y.

TRADE — Triplett 1200G; Hickok 133 voltohmeters; Webcor 356 changer with 2 GE cartridges and 100-4 changer. Want stamps of early U.S. or British Colonies or Benelux countries, Israel, Vatican, or U.N. Sydney Rosen, 238 8th Ave., Paterson, N. J.

FOR SALE — RME 100 speech clipper and DB22A pre-amplifier; Millen R89er; Johnson signal sentry; Gonset 100% modulation monitor; 1500 v., 250 ma plate xformer. F. W. Jones, Gabbs, Nev.

FOR SALE — Gonset tri-band converter, very good cond., $20. Vincent Genzardi, 11 Harlow Crescent, Fair Lawn, N. J.

FOR SALE — Sams Photofacts, 110-314, l. n., $1 each; Sylvania 220 tube tester, $40. R. B. Watkins, South Dixie St., London, Ky.

SELL OR SWAP — TV-101 Mallory converter; model 200 AM-FM sig. gen.; Alliance 3-tube booster. Want remote control equip. 27.255. Wee Fixit Shop, Box 240, Hurricane, W. Va.

FOR SALE — 35 w. novice xmitter, $10; 35" rack cabinets, $12; 75 w. all-band xmitter by commercial mfgr., $35; NRI VTVM, $10; 125 w. multi-band RF ampl., $40. Ellsworth, 245 Fir, Park Forest, Ill.

TRADE — Over 50 assorted relays, reversible motors, and solenoids (60 to 70 lbs.) for Heathkit AG-9 audio generator. Will correspond for details. V. F. Graham, Rose Valley Rd., Rose Valley, Wallingford, Pa.

FOR SALE — Eico 360K sweep gen. and 425K scope, both factory calibrated and checked; Jackson 640 sig. gen., all like new. Make reasonable offer. Local preferred. Mack London, 770 East 180th St., Bronx 60, N. Y.

FOR SALE — Radio-TV Supply Sales and Service business. Retiring after 40 years. Pete's Radio-TV Supply, 57 Lakeview Ave., Lowell, Mass.

FOR SALE — Meissner 8-C FM tuners; Fada 795 FM tuner. Never used. Joe Billingsley's Radio Service, Box 153, Hardy, Ark.

NEED — Set of plugs and connectors for BC375E xmitter to its allied generator, batteries, etc. State price postpaid. Also any BC375E information concerning successful operation on ham bands. Zwierzanski, Belle Mead, N. J.

FOR SALE — Precision E400 sweep sig. generator hardly used, with 2 xtals and cables, $75 plus shipping charges. J. E. Strenk, Losee Rd., Wappingers Falls, N. Y.

SELL OR SWAP — Webster-Chicago 80 wire recorder 80; Lear aircraft xmitter 50 w. 2700 kc. to 7000. Want Hallicrafter S-40 or 15 w. amplifier. Fred Welch, 845 Allingham, Van Wert, Ohio.

WANT — Test equipment, VTVM, audio oscillator, scope, commercial built units only; for cash. L. Walter, 24 Carlton Terr., Rutherford, N. J.

WANTED — Fine to unc. U.S. coins in exchange for l. n. Hickok 620 linearity pattern generator and books on TV. Stallcup, 1030 Murfreesboro Rd., Nashville, Tenn.

FOR SALE — Simpson 383 in-circuit capacitor leakage tester, $60 and Senco BE 2 TV bias supply, $5 COD. Redd's TV Service, Box 12, Union Furnace, Ohio.

FOR SALE — Professional 17" recording lathe, $125, less cutting head; Magnecord F-35B, still in warranty, $275; Variac, type 100-R, $45. 14 and 20 cutting stylii, all l. n. John T. Moore, Seneca, S. C.

SELL OR TRADE — Complete darkroom, with Omega 5x5 enlarger, print dryer, printing paper, film safe, bulk chemicals etc. Want ham gear or best offer in cash or test equipment for ham shack. Myron L. Braun, 202 Howard St., Bellevue, Ohio.

FOR SALE — Course, text, and reference books — radio and electrical; electrical and radio parts; back issues Popular Mechanics, Popular Science, Science and Mechanics, Mechanics Illustrated, Radio News, Photography, etc. J. O. Heustis, 5341 Ebell St., Long Beach, Calif.

WANTED — UTC, CVM-1, xformer and Microvox. Have Hallicrafters S20R rcvr, good cond., $35; RCA 4-band long wave rcvr, $10. W. Gieckel, 22-43 35th St., Astoria 5, L. I., N. Y.

SELL OR SWAP — UHF standard strips, 19, 29, 32, 34, 43 F, G, Q. boxed, $3 per set or swap for channel 22 strips. Beach Radio, 2715 N. Water, Corpus Christi, Tex.

SWAP — Meissner 8C FM tuner, good cond., aligned no cabinet, with 6AL7 tuning indicator, for HO railroad equipment, 12 v. DC power supply, or make offer. H. C. Cohan, 3504 Carlsbad Way, Riverside, Calif.

FOR SALE — Collins plate xformer, multi-tap primary, potted, 1100 vct. at .212 amps; Electro battery eliminator; 10 henry 200 Ma. choke; 5 vct at 15 amps; Mobile xmitter; Lester converter. Want sweep gen., 5" scope, or cash. N. Inventasch, 320 East 176 St., New York 57, N. Y.

FOR SALE — E-400 Precision sweep gen.; NRI 88 RF-AF sig. gen.; Coyne's Applied Practical Radio and TV, 6 vol.; RCA 45 rpm and 78 rpm automatic record players, need needle only. C. W. Chastain, 228 Timber Lane, Memphis 12, Tenn.

FOR SALE — Approved A-710 AM-FM tuner with power supply, $30; Magnavox AM-FM chassis with 20 w. amplifier and 15" coaxial speaker, $35. Prefer local. J. Leonard Herron, 6340 Magnolia Ave., Chicago 40, Ill.

SELL OR TRADE — Several hundred cartoned radio-TV tubes l. n.; Sams and Rider manuals, reasonable, or trade for good metal lathe in or around Missouri. Have also Precision E-200 sig. gen., l. n., $35 prepaid in U.S. Harold Garrett, 711 South New York, Sedalia, Mo.

SELL OR SWAP — Isolation 175 w.xformer; velocity microphone HI-2, absorption, wave meter (17-40) (100-300) (400-500) MC. Want working or repairable test equipment. Glenn Seaton, 10023 Madison Ave., Cleveland 2, Ohio.

FOR SALE — DeVry, Victor, Kodascope, Bell & Howell sound projectors — 30 day trial. Ed Polewka, 13902 Euclid Ave., Cleveland 12, Ohio.

FOR SALE — Allband rack and panel 100 w. xmitter VFO-Xtal PP807s, $75; B&W coax low pass xmitting filter unused, $8.50. P. Boothroyd, 142-G, Sparta, N. J.

WANTED — Back issues of C-D Capacitor; Vol. 1 No. 4, Oct., Nov., Dec. 1937; Vol. 3 No. 2, Jan. to Dec. 1939. Joseph J. Simpson, 85-39 152nd St., Jamaica 32, N. Y.

FOR SALE — RCA 630 TV chassis converted to 16" with CRT, good operating cond., homemade cabinet on legs with casters, $50. L. Chernoff, 30 Dewey St., Newark, N. J.

FOR SALE — Like new: RCA WR39C TV sig. gen. and WR59C TV sweep gen., complete with all cables and inst. manuals, both for only $250 plus express. W. F. Houghtling, 336 Wardman Rd., Buffalo 23, N. Y.

FOR SALE — Complete NRI Radio-TV course including some color, $35. F. M. Eberly, 118 N. Orange St., New Smyrna Beach, Fla.

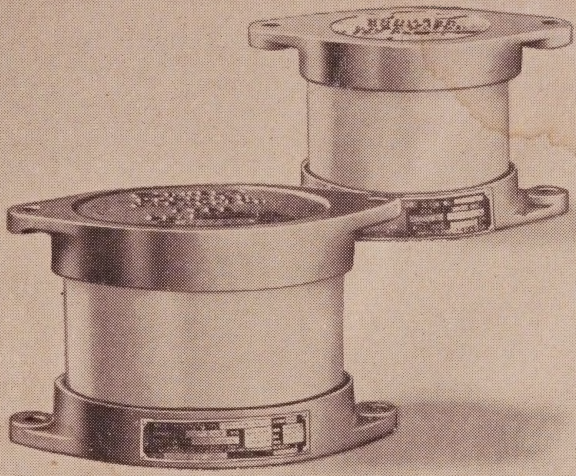
FOR SALE — Portable PA system for music or speech use, with 20 w. amplifier, 12" speaker, 3 inputs, external speaker output, Turner mike and stand, 100 ft. mike cable. Carl Solomon, 35 Rainbow Lane, Levittown, N. Y.

WANTED — Set of coils for Hallicrafters HT-17 xmitter. Richard Barch, 6 Ford Terr., Woburn, Mass.

WANTED — Radio marine gear, ship-to-shore phone; radio direction finder; depth indicator; portable battery rcvr with long wave, broadcast, and 2-4 meg. bands. Write data, prices. David Robbins, 25 Kensington Circle, Chestnut Hill, Mass.

TRADE — Ampro 16mm Premier 20 sound projector, two cases, 12" speaker, l. n. (Cost $475); Gonset Tri-Band converter for 12 v. use. Want communication rcvr, xmitter, signal tracer. M. Feigenbaum, 160 West Euclid St., Hartford 12, Conn.

FOR SALE — A-200 AE1 sig. gen. exc. cond., 100 kc. to 75 mc. in 8 bands, complete, $18. John Leuck, 1419 Rowland St., Bronx 61, N. Y.



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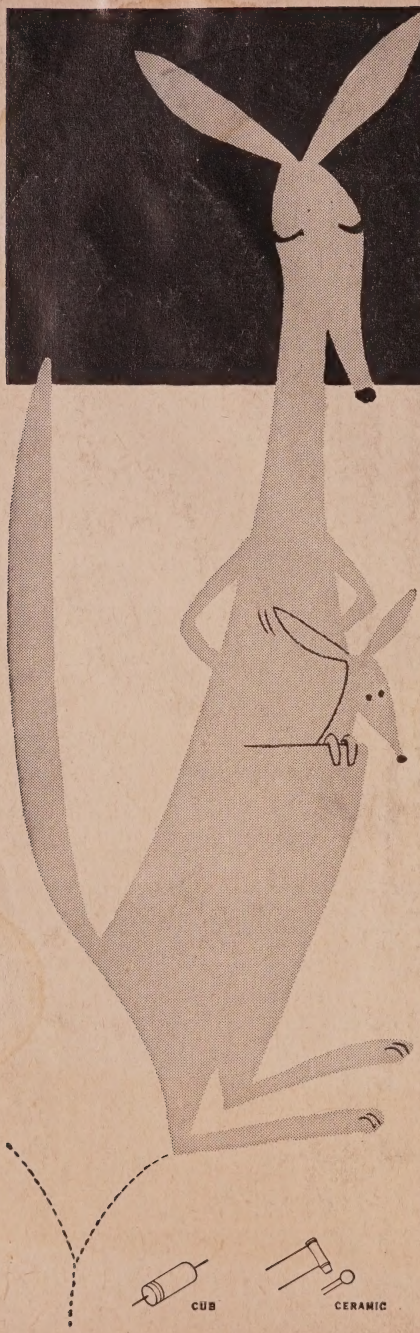

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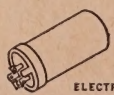

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